FORMAT TO UPLOAD SYNOPSIS

S.NO.	DETAILS	DESCRIPTION
1.	**INSTITUTION NAME**	**LAKSMIBAI NATIONAL INSTITUTE OF PHYSICAL EDUCATION, NORTH EAST REGIONAL CENTRE, GUWAHATI**
2.	**DEPARTMENT**	**DEPARTMENT OF PHYSICAL EDUCATION**
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5.	**TYPE OF DEGREE**	**DOCTOR OF PHILOSOPHY**
6.	**REGISTRATION YEAR** (YYYY, e.g. 2021)	**2021**
7.	**TITLE/TOPIC** (Special Characters &! #$%^*() +=-[] \\\';,./{}]\:? etc. are not allowed)	**EFFECTS OF SELECTED YOGA ASANAS, PLYOMETRIC TRAINING, AND ITS COMBINATION ON PHYSICAL FITNESS AND HIGH JUMP PERFORMANCE OF INTER-UNIVERSITY ATHLETES**
8.	**ABSTRACT** Abstract should not contain any [E.g.!@ #$%^&*() etc. and more than 2048 characters will not be acceptable]	This research examines the effects of selected yoga asanas, plyometric training, and their combined implementation on physical fitness parameters and high jump performance among inter-university athletes. The study focuses on enhancing specific athletic capabilities including explosive strength, stride length, dynamic balance, coordinative abilities, and flexibility, which are crucial determinants of high jump performance. Forty elite athletes (aged 17-25 years) from Rajasthan will be randomly assigned to four experimental groups: yoga training, plyometric training, combined yoga-

		plyometric training, and a control group. A pre-test/post-test experimental design will be employed with a 12-week intervention protocol. The yoga program incorporates postures targeting flexibility, leg power, and explosive strength, while the plyometric regimen focuses on developing neuromuscular efficiency and power production capabilities. The combined approach integrates both methodologies to potentially achieve synergistic training effects. This investigation hypothesizes that while both individual interventions will yield significant improvements, the combined training approach may produce superior enhancements in the selected variables due to complementary physiological adaptations. Descriptive statistics will summarize the data, while multiple discriminant analysis will be employed to classify players into singles or doubles categories based on the predictor variables. The study hypothesizes that a significant discriminant model can be developed to distinguish between the two player categories, aiding in early talent identification and specialized training. The findings could provide coaches and physical educators with evidence-based training protocols that optimize high jump performance through improved physical fitness parameters. This research contributes to the scientific understanding of specialized training methodologies for vertical jumping events and their practical applications in competitive athletics.
9.	**KEYWORDS** (please mention more than one keyword)	**Yoga asanas, Plyometric training, Combined training, High jump performance, Explosive strength, Dynamic balance, Flexibility, Coordinative abilities, Inter-university athletes, Athletic performance.**
10.	**LANGUAGE**	**ENGLISH**
11.	**ATTACH SYNOPSIS** (PDF not more than 10 MB)	**SYNOPSIS ATTACHED**

"EFFECTS OF SELECTED YOGA ASANAS, PLYOMETRIC TRAINING AND THEIR COMBINATION ON PHYSICAL FITNESS AND HIGH JUMP PERFORMANCE OF INTER-UNIVERSITY ATHLETES"

SHORT SYNOPSIS

Submitted in Partial Fulfilment for the requirement of the award of the degree of

Doctor of Philosophy
in
Physical Education

Submitted by
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(Reg. N0. - 172)

Under the Supervision of
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Submitted to

Department of Research committee

LAKSHMIBAI NATIONAL INSTITUTE OF PHYSICAL EDUCATION NERC, GUWAHATI

Lakshmibai National Institute of Physical Education NERC, Guwahati

Certificate

I hereby declare that the short synopsis titled **"Effects of Selected Yoga Asanas, Plyometric Training, and Its Combination on Physical Fitness and High Jump Performance of Inter-University Athletes**" being submitted in partial fulfilment of the requirement for the degree of Doctor of Philosophy in Physical Education from Laksmibai National Institute of physical Education, NERC, Guwahati during the academic year 2021-2022.

It is a Bonafide record of original work carried out under the supervision of Dr. Satpal Yadav and has not been submitted in full or part to any other university or institute for a degree or diploma. Further, it is certified that the short synopsis is plagiarism-free and the proof has been submitted.

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ABSTRACT

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Chapter – I

Introduction:

Physical training entails exposing the organism to a training load or work stress of sufficient intensity, duration and frequency to produce a noticeable or measurable training effect, that is, to improve the functions for which one is training. The performance variables are highly important in the achievement of outstanding results in sports performance. However, one of the performance variables like speed as an innate quality, proper and scientific training tends to improve most of the performance variables. In the case of majority of sports events and competitions it is the performance of the performance variables such as speed, power, strength, endurance, agility and cardio respiratory endurance, that often decide the fate of the event. High-level performance of a high jump player may be depending upon its physical capabilities supported by other factors. In most of advanced and developed countries, the awareness of the fitness, motor learning and skill development among children in early age itself are very much scientific to realize their dreams of high achievements in sports. High level of general fitness with motor abilities like speed, power, strength, endurance, agility, cardio respiratory endurance, jumping activity etc., are essential qualities required to be developed by high jumper's performance.

Yoga is a science of right living and it works when integrated in our daily life. It works on all aspects of the person, the physical, mental, emotional and spiritual. The word yoga means "unity" or "oneness" and is derived from the Sanskrit word "yuj" which means "to join". Yoga is an ancient science, which originated in India. Yoga includes diverse practices such as physical postures (Asanas), regulated breathing (Pranayama), meditation

and lectures on philosophical aspects of yoga. Pranayama has been assigned a very important role in yogic system of exercises and is said to be much more important than yogasanas for keeping a sound health. With increased awareness and interest in health and natural remedies, yogic techniques including pranayama's are gaining importance and are becoming acceptable to scientific community. There are several types of pranayama derived from the "bellow" used by the blacksmith to keep his coal furnace alive. The word Yoga automatically calls to mind Sage "Patanjali" the founder and father of Yoga. He lived around three centuries before Christ, and was a great philosopher and grammarian. He was also a physician and a medical work is attributed to him. However, this work is now lost in the pages of time. Yoga helps to promote mental and physical relaxation, but that's not the only benefit it provides. In fact, yoga can be a beneficial component of any cross-training routine for athletes, and it can enhance performance in other sports as well. Research has suggested that yoga improves flexibility, balance, coordination, and lung function. It can also help athletes effectively manage stress, an often forgotten but key contributor to recovery and performance. In any kind of sports there is a lot of basic variants of sport training (physical, technical, tactic, integral and so on). There appears a question to what extent these kinds of sportsmen of team's training can be effective with the help of yoga.

Yoga exercises and methods can directly influence on optimization of all kinds of sportsman' or team's training. It is important for sportsman and his coach to understand what is to be taken from ancient science about self-development for increasing of sport results and improvement of training process's quality, because yoga exercises can be used in sport practice in rather different way.

Regular practice of different yoga postures (asanas) as well as breathing exercises (pranayama) help to strengthen muscles, develop qualitatively new power and improve muscular elasticity and mass. As a result, strength and endurance of organism in general are improved, but not only of separate muscular groups and it renders additional effectiveness in trainings and competitions. For high jumper it is very important to control body. Owing to yoga practice, one can develop excellent balance, which facilitates better control of movements, its position in space and, in its turn, improves technique and

coordination of movements. One of the most known pluses of yoga is development of profound and steady flexibility that is very important for high jumper good flexibility helps to avoid traumas, increases amplitude of movements, makes muscular work more energy saving and effective owing to increased muscular elasticity. Thus, it is assumed that physical training for maintaining optimal physical condition, technical training for improvement of sportsmanship and tactic training, oriented on development of strategic and tactic skills can be improved with the help of yoga exercises, which, at the same time, harmoniously influence on mind and body. while study of yoga influence on sport preparedness would help to solve this problem.

Yoga benefits for sports

Yoga is the oldest known science of self-development, originated in ancient India. Yogic practice is a physical and mental exercises practiced throughout the world. Many research studies of the past report that yogic training improves the physical & mental fitness level as well as the performance of sports persons in various sports disciplines. Yoga postures are the physical positions that coordinate breath with movement and with holding the position to stretch and strengthen different parts of the body. Asana practice is the ideal complement to other forms of exercise especially running, cycling and strength training, as the postures systematically work all the major muscle groups, including the back, neck and shoulders, deep abdominal, hip and buttocks muscles and even ankles, feet, wrists and hands.

By their very nature, asanas affect major and minor muscle groups and organs as they simultaneously import strength, increase flexibility and bring nourishment to internal organs. Although most poses are not aerobic in nature, they do in fact send oxygen to the cells in the body by way of conscious deep breathing and sustained stretching and contraction of different muscle groups. Whatever sport we choose to practice, yoga can enhance and complement our ability. Most sports build muscular strength and stamina, often in specific areas of the body. Yoga can help to check any imbalance in muscular development and will enable both our body and our mind to function more efficiently. If our body is flexible and supple, we will be less prone to sports injuries, as our joints will be kept lubricated.

Plyometric

Plyometric exercise refers to those activities that enable a muscle to reach literally means to increase measurement (pilo=more; metric = measure) (Giridharaprasath and Murugavel, 2015). Practically defined, plyometric exercise is a quick, powerful movement using a pre stretch or counter movement that involves the stretch shortening cycle (SSC) (Shah, 2012)

The purpose of plyometric exercise is to increase the power of subsequent movements by using both the natural elastic components of muscle and tendon and the stretch reflex. To effectively use plyometrics as part of a training program, it is important to understand; (1) the mechanics and physiology of plyometric exercise. (2) principles of plyometric programme design and (3) methods and safely and effectively performing specific plyometric exercise.

Plyometrics is a traditional form of resistance training emphasizing the loading of muscles during an eccentric muscle action, which is quickly followed by a rebound concentric action (Steben and Steben, 1981; Duda, 1988). Presently, plyometrics are also being used for lower and upper extremity rehabilitation. Numerous authors have documented lower quarter stretch shortening exercise drills and programs, but the literature is deficient in upper extremity stretch-shortening exercise programs (Chu, 1984; Voight and Draovitch, 1991).

Plyometrics: Any exercise in which muscles are repeatedly and rapidly stretched and then contracted (as in jumping high off the ground or in push-ups with a clap between them). The aim of plyometrics is to improve muscle power.

Plyometric training is an intense, advanced form of exercise in which the muscles are first stretched, then contracted (the pre-stretching makes the muscle contract with greater force). Plyometric movements are powerful and high-impact, although the impact should be controlled as much as possible. Plyometric training requires both strength and endurance. Common plyometric training exercises include various jumps and hops, sometimes using obstacles such as steps or cones.

Plyometric is exercise designed to enhance the athlete's ability to blend speed and strength training. It is in effect "the icing on the cake" when sound training principles are used, Plyometric offers the mechanism by which an athlete can start quicker, change direction more rapidly, accelerate faster and improve overall speed. The actual form, Plyometric was first coined in 1975 by Fred wilt. One of America's more forward-thinking Track & field coach.

Plyometric training is an excellent method of developing body power and it is proved to be a very effective method for improving explosive strength. It offers rich variation of exercises and load structure. Any activity that activates the stretch reflex mechanism is Plyometric exercise. Plyometric exercise based upon the belief that a rapid lengthening of a muscle just prior to the contraction will result in much stronger contraction. Plyometric training may be viewed as an extension of the "shock" method of strengthening muscle for athletic performance recommended by Verhoshanki of Russia. The shock method advocated By Verhoshauki consisted of rebound jump from a height to develop the "reactive" neuromuscular apparatus of the athlete.

Plyometric training involves simultaneously voluntary and involuntary muscle contractions. Therefore, more motor units are called open during a single contraction of this type than would be used in either contraction alone. In Plyometric exercises eccentric contraction is followed immediately by a concentric contraction.

One of the many benefits of Plyometric training is that it can be organized into circuits. by moving from station to station the athlete can do a variety of exercise that stresses either the vertical or linear components of various movements' patterns or both. By using circuits, athletes can perform activities of even greater duration than with anaerobic, sprint and interval training. This may move the level of cardiovascular stress toward improvement in aerobic conditions, resulting in increased stamina.

High jump event

High jump contests were popular in Scotland in the early 19th century, and the event was incorporated into the first modern Olympics Games in 1896 for men. Women made their Olympic high jump debut in 1928. Of the field events, the high jump has

perhaps undergone the most radical changes of technique. The Eastern Cut-off, Western Roll and Straddle are methods that have been previously used by the world's elite. However, the Fosbury Flop, which involves going over with the jumper's back to the bar, popularized by the 1968 Olympic champion Dick Fosbury, is now almost exclusively the technique adopted by all the top high jumpers. Javier Sotomayor won Olympic gold at the 1992 Barcelona Olympics. The Cuban great set the current high jump world record of
2.45m in 1993 and is the first man in history to jump over 8ft. One of the greatest women's high jumpers in history is Iolanda Balas. The Romanian great won back-to-back Olympic titles in 1960 and 1964 and went 11 years unbeaten in her event.

One of two field events also referred to as vertical jumps, competitors in the high jump take off (unaided) from one foot over a four-meter-long horizontal bar. They seek to clear the greatest height without knocking the bar to the ground. Athletes land on a crash mat. All competitors have three attempts per height, although they can elect to 'pass', i.e. advance to a greater height despite not having cleared the current one. Three consecutive failures at the same height, or combination of heights, leads to elimination. If competitors are tied on the same height, the winner is the one with fewest failures at that height. If competitors are still tied, the winner will have had the fewest failures across the entire competition. Thereafter, a jump-off will decide the winner. The jump-off will start at the next greater height. Each jumper has one attempt and the bar is lowered and raised until one jumper succeeds at one height.
The event demands speed, explosive power and agility among other qualities. At major championships the format is usually a qualification competition followed by a final.

Statement of the Problem

The fundamental reason to train with plyometrics is to reduce the ground contact time that an athlete spends when running or jumping. This time is reduced as the athlete matures, gets stronger, and practices the skills of their game. It is a well-known fact that plyometric training has been shown to increase performance variables, however little scientific information is available exploring combined effect of plyometric exercises

followed by yoga practices on physical fitness variables and performance ability. This prompted the researcher to undertake the study entitled "**Effects of yoga, plyometric training and their combination on physical fitness and performance of inter-university high jumper players**" with the aim to assess the effect of conventional plyometric training and yoga practices alone as well as in combination.

Research Question

- What would be the effect of selected plyometric training on the physical fitness and high jump performance of Athletes.
- What would be the effect of selected yoga training on the physical fitness and high jump performance of Athletes.
- What would be the effect of the stimulus of selected plyometric plus yoga training programmed in improving specific physical fitness variables of the athletes.

Objectives of the Study

- To assess the selected fitness variables and performance of high jumpers.
- To prepare specific training schedules of plyometric exercises and yoga practices considering the enhancement of the selected fitness variables and performance.
- To conduct a controlled experiment for evaluating the efficacy of the newly designed training programmes on the selected variables so as to exhibit top performance in high jump events.

Hypotheses:

On the basis of literature available, so far, it is hypothesized that:

H1: There will be significant difference between the selected plyometric training and the selected variables (high jump performance of Athletes).

H2: There will be significant difference between the selected yoga training and the selected variables (high jump performance of Athletes).

H3: There will be significant difference between the selected plyometric training plus yoga training and the selected variables (high jump performance of Athletes).

Delimitation

1. The study will be delimited to all athletes of inter-university events.
2. The study will be conducted on inter-university athletes of different districts of Rajasthan State.
3. Total 40 athletes will be selected as subject for this study.
4. The study will further be delimited to the different variables i.e., Explosive strength, Stride length, Dynamic Balance, Selected coordinative abilities, Flexibility, and high jump performance.
5. The duration of training was of 12 weeks only.

Limitations:

1. No special motivational technique used to encourage the subjects to do their best during their practice or the test.
2. The race, community, family background and socio-economic status were considered as limitation of this study.

Significance of the study:

Plyometric training and yoga training program has been offered as a suitable methodology for sports, which need vertical jumping ability, Explosive strength, Stride length, Dynamic Balance, Selected coordinative abilities, Flexibility, and high jump performance. Also, it is used to give the players to jump higher level and to enhance the jumping capacity of leg muscles. This program offers functional intensification of the

tendon, ligaments and muscle particularly to the everyday demand sports and activities. This plyometric training and yoga training program covers a learning practice requiring an efficient design as well as application with maximum care. That is the main motive why the significance of plyometric training, yoga training and their combination program is overstated in this research.

The results of the study may help the coaches and physical education teachers to improve the Broad Jump performance.

A remarkable effect of training can be finding out on the plyometric training; yoga training would be beneficial to enhance the physical fitness and performance of high jumpers. The stimulus of selected plyometric plus yoga training programme may be effective in improving specific physical fitness variables of the athletes

This study may help the physical educationist's coaches and research scholars for further research.

Chapter – II

Review of literature:

Before formulating the research, problem researcher has done extensive review related to athletic performance and various training interventions. The chapter is organized in two heads: (i) Studies on Yogic Practices and (ii) Studies on Plyometric Training. Some of the studies related to this topic are enumerated as follows:

Studies on Yogic Practices

Tripathi and Nayak (2022) revealed that the yoga is the ultimate technique which produces a marvelous change in the life style. The criminal nature of the unsocial elements can be changed by yoga. The sentiment of dissatisfaction egotism, anger, greediness, attachment etc. are the root cause of crime, when a person being aware and

conscious by yoga practice recognizes its basic nature and suffering gained by the ill statement then a change appears in his mind and he live a decent social life, which is full of softness, piousness, friendliness and happiness. In this paper, impact and yogic practices in game and sports were reviewed in last decades. The significance of the reviewed was yogic practices and training is considered effective in improving physiological and psychological balances of the players. Yoga plies an important role by bringing the therapeutic effect in asthma, diabetes, hypertension and respiratory troubles. Some yoga has both preventive as well as curative value. Positive changes in the life style of the people can be brought through yoga. During the period of education, Yoga can make them aware of their bodies and further make them realize the need of physical and emotional wellbeing. Yoga controls one of sense resulting in an integrated personality and behavior can be molded properly leading to balanced personalities. Yoga can help to check any imbalance in muscular development and will enable both mind and body to function more efficiently. Practicing of yoga asanas strengthen the muscles, release physical tension and improve concentration and poise. Yoga makes limbs balanced strong

and relaxed. The standing poses improve balance and muscle flexibility. Yogic practice can help players to relax and replenish their energy after strenuous games. It also promotes calm, clear thinking even in situations that call for fast reactions. Yoga stretches and strengthens all muscles of body and brings peace and calm to the mind and spirit.

Sunitha (2022) stated that Yoga offers new learning possibilities to a wider group of students than traditional sports or fitness curriculum, making it a valuable addition to any educational program. Additionally, adding yoga to a school's curriculum will help provide a quality physical education program as modification of traditional physical education yoga in sports as important as other think it helps us in different ways and different levels in a sports men life. Yoga can play a key role in cultivating mind control and concentration which helps a sportsperson to perform at their game. It offers children and adults an opportunity to experience success in physical activity, which can help build a foundation of strong of life. However, curriculum specialists, teachers, trainers and students should know and analyses seriously the real challenges of yoga education in classroom settings and real life as well.

Biswas *et al*. (2021) revealed inclusion of yogic practice in training sessions for cricketers plays an important role to improve motor fitness which is a key factor of performance. Thirty male district level cricketers with a mean age of 17.8 ± 1.6 years were selected and randomly divided into two equal groups. One group underwent through selected yogic asana practices along with their regular training and another group did not include yogic asana practice in their training schedule. Basic physical and physiological parameters along with some cricket specific motor fitness components were measured before and after four weeks of yogic practices. The basic physical appearances of two groups were merely similar and a low resting heart rate has been observed among cricketers. Four weeks of yogic practice significantly improved the muscle endurance, agility and balance. A positive effect was also observed in the predicted VO_2 max.

Dharmaraj and Pushparajan (2017) investigated the impacts of shifted frequencies of Yogic Practices on the improvement of physiological factors of Middle-Aged Men. In the investigation, the outcome demonstrated that the physiological factors diminished the pulse because of the yogic practices.

Elumalai (2017) studied the effect of yogic practices on tidal volume and anxiety among middle aged men. The results of the study that yogic practice has increased the tidal volume and decreased the anxiety significantly. It was found that there was a significant difference was occurred between the yoga practice group and control group on tidal volume and anxiety.

Engarsal (2017) investigated an exploratory study of low back pain among the yoga practitioners and non-yoga practitioners in relation to specific life style factors. The findings of the study were the selected yogic practices group than the control group has significant ($P<0.05$) effect on the anger and heart rate level.

Prabu and AseerRufus (2016) found out the effect of yogic packages and mobility training on selected bio-chemical variables among volleyball players. To achieve the purpose of the present study, sixty men volleyball players from Kanyakumari district, Tamil Nādu, India were selected as subjects at random and their ages ranged from 18 to 25 years. The subjects were divided into three equal groups of twenty players each. Experimental Group I was exposed to yogic packages; Experimental Group II was exposed to mobility training and Control Group was not exposed to any experimental training other than their regular daily activities. The duration of experimental period was 12 weeks. The pre-test and post test scores were subjected to statistical analysis using Analysis of Covariance (ANCOVA) to find out the significance among the mean differences, whenever the 'F' ratio for adjusted test was found to be significant, Scheffe's post hoc test was used. In all cases 0.05 level of significance was fixed to test hypotheses. The yogic packages group had shown significant improvement in all the selected bio- chemical variables among volleyball players after undergoing yogic packages for a period of twelve weeks. The mobility training group had shown significant improvement in all the selected bio-chemical variables among volleyball players after undergoing mobility training for a period of twelve weeks.

Beutler *et al*., (2016) examined whether yogic subjects (YOGA) show an increased endurance capacity compared to matched non-yogic individuals (CON) with similar physical activity levels. Resting ventilation, the ventilatory response to hypercapnia, passive leg movement and exercise, as well as endurance performance were assessed.

YOGA (n = 9), compared to CONTROL (n = 6), had a higher tidal volume at rest (0.7±0.2 vs. 0.5±0.1 l, p = 0.034) and a reduced ventilatory response to hypercapnia (33±15 vs. 47±15 l·min-1, p = 0.048). A YOGA subgroup (n = 6) with maximal performance similar to CONTROL showed a blunted ventilatory response to passive cycling (11±2 vs. 14±2 l·min- 1, p = 0.039) and a tendency towards lower exercise ventilation (33±2 vs. 36±3 l·min-1, p = 0.094) while cycling endurance (YOGA: 17.3±3.3; CON: 19.6±8.5 min, p = 0.276) did not differ. Thus, yoga practice was not associated with improved exercise capacity nor with significant changes in exercise ventilation despite a significantly different respiratory regulation at rest and in response to hypercapnia and passive leg movement.

Richter *et al*., (2016) investigated the effects of yoga training, as compared to physical skill training, on motor and executive function, physical self-concept, and anxiety-related behavior in junior primary school-aged children. Twenty-four participants with a mean age of 8.4 (±1.4) years completed either yoga or physical skill training twice a
week for 6 weeks outside of regular school class time. Both forms of training were delivered in an individualized and child-oriented manner. The type of training did not result in any significant differences in movement and executive function outcomes. In terms of physical self-concept, significant group differences were revealed only for perceived movement speed such that yoga training resulted in perceptions of being slower while physical skill training resulted in perceptions of moving faster. Analysis of anxiety related outcomes revealed significant group effects only for avoidance behavior and coping strategies. Avoidance behavior increased following yoga training, but decreased following physical skill training. In addition, following yoga training, children showed an increased use of divergent coping strategies when facing problematic situations while after physical skill training children demonstrated a decrease in use of divergent coping strategies. Changes in overall physical 45 self-concept scores were not significantly correlated with changes in avoidance behavior following yoga training. In contrast, following physical skill training increased physical self-concept was significantly correlated with decreases in avoidance behavior. In sum, exposure to yoga or physical skill training appears to result in distinct effects for specific domains of physical self- concept and anxiety-related behavior. Further studies with larger samples and more rigorous methodologies are required to further investigate the effects reported here. With

respect to future studies, we address potential research questions and specific features associated with the investigation of the effects of yoga in a sample of school-aged children.

Khosravi *et al*. (2015) determined the impact of general program of yoga on the muscle fitness, body composition and metabolic risk factors in middle age women with overweight. Thirty middle age women with overweight were randomly assigned to the yoga intervention group or the control group. Muscle endurance and flexibility, fat
percentage, body mass index (BMI), blood glucose and lipids levels were obtained, before and after 8 weeks of yoga practice. Data analyzed with independent t test by SPSS 19. Data indicates that significant increase in muscle endurance ($p = 0.012$) and flexibility ($p = 0.049$) occurred in yoga group but not in control group. Significantly decrease in BMI and body fat percentage than control group observed ($p \leq 0.0001$). There were no significant differences between control and yoga group in glucose, total triglyceride and total cholesterol. These findings suggest that middle age women with overweight may benefit from yoga practice to improve the muscle fitness and body composition

Studies on Plyometric Training

Aloui and his co-workers (Aloui *et al*., 2021) examined the effects of 8 weeks of twice-weekly combined plyometric and sprint with change-of-direction (CPSCoD) training into habitual training regimes of young male soccer players. Participants were randomly allocated to an experimental group (n = 17, age: 14.6 _ 0.44 years, body mass: 61.2 _ 7.34
kg, height: 1.67 _ 0.09 m, body fat: 11.2 _ 1.56%) and a control group (n = 16, age: 14.6 _ 0.39 years, body mass: 61.1 _ 3.96 kg, height: 1.67 _ 0.05 m, body fat: 11.8 _ 1.47%). Measures obtained pre- and post-intervention included vertical and horizontal jump performance (i.e., squat jump (SJ), countermovement jump (CMJ), and standing long jump (SLJ)), and sprint performance (i.e., 5 m and 20 m sprint). In addition, Measures obtained pre- and post-intervention included change-of-direction ability (4 _ 5 m sprint test (S 4 _ 5 m) and sprint 9–3–6–3–9 m with backward and forward running (SBF)), repeated change of direction (RCoD), and static balance performance (stork balance test). The training group experienced superior jump (all $p < 0.05$; d _ 0.61), sprint (all $p < 0.05$; d _ 0.58), change-of-direction (CoD) ability (all $p < 0.05$; d _ 0.58), RCoD (all parameters except the fatigue index $p < 0.01$; effect size (d) _ 0.71), and static balance (all $p < 0.05$; d _ 0.66)

improvement. Adding twice-weekly CPSCoD training to standard training improves the anaerobic performance of U15 male soccer players

Thaqi *et al*. (2021) evaluated the effects of plyometric training on the shot-put technique. It was oriented to improve the basics for the development of power related- indicators such as power (explosive force), acceleration speed, and strength endurance. The study sample included 220 male students, aged 16 years ± 6 months from Fehmi
Lladrovci High School, Glogoc municipality, Republic of Kosovo from the 2019/2020 academic year. The experimental group (110 male students) applied a 12-week program (see the training program paragraph). The control group (110 male students) continued only with their regular physical education lessons (2 times a week). To determine the differences between pre- and post-test values of the control and experimental groups ANOVA calculations were made. The development percentage in time (between pre-test and post-test) were calculated using the formula:
$\Delta\%$ = (x post-test – x pre-test) / pre-test
*100. Results of the study show that pre- and post-test average values (tests within subjects) of the shot-put technique ($p<0.05$) were statistically different according to measurement over time (interaction; $p<0.05$), and in tests between the subjects ($p<0.05$). The shot-put technique ($\Delta\%$: 50.88) test of the experimental group (plyo-training) had higher developmental percentages compared to ($\Delta\%$: 1.69) the control group ($p<0.05$). When analysing the developmental percentage, it was observed that the performance of the shot-put technique of the experimental group compared the control group 49.2% more developed. Furthermore, the impact of the plyometric training program in motor abilities related to the shot-put technique also observed similar improvements in the impact of the shot-put technique.

Muhammad *et al*. (2020) stated that plyometrics are exercises that involved the enhancement of muscle performance. The objective of this study was to evaluate the effects of 6-weeks plyometric training on speed and agility performance among recreational football players. This study was conducted following the pre-post-test model
of quasi-experimental method. Twenty-two recreational football players were chosen for this study (aged between 19 to 26 years old) and randomly assigned into control (N=11) and intervention group (N=11) for six weeks. Subjects in the control group did not

undergo any plyometric training. In contrast, the intervention group performed plyometric training for six weeks. All subjects participated in two tests; 1) Sprint test of 20 m distance for speed performance and; 2) Agility test using Agility T-test for agility performance before (pre) and after (post) training. For the intervention group, significant improvement in the difference of sprint time before and after six weeks of training were discovered (t= 3.76, p= 0.001) when compared to the control group. The agility performance of the intervention group also showed significant difference when compared to the control group (t= 2.53, p= 0.01). Therefore, this will help players to improve their performance during a football match and prevent injury among recreational football players.

Hrzenjak *et al*., (2016) determined the effects of plyometric training on kinematic parameters in junior female volleyball players. Method: Sixty female volleyball players participated in this study. Players were members of youth and junior squads from several Serbian volleyball clubs. The recordings of volleyball spike jumps were made with a Panasonic NV-MS1 camera, which recorded a rate of 50 frames per second. Recorded data were downloaded to a computer and coordinate data were digitized with the help of software for 2D kinematic analysis. Results: Both the plyometric and the control group showed significant improvement ($p < 0.05$) in joint kinematics from pre- to post-training on most of the measures for linear velocity. However, no significant differences were found between initial and final measurement for angular joint velocity. Conclusion: The use of a modified or different plyometric training program could potentially improve player's movement and performance, and lower the athlete's risk for injury. More research is needed to determine whether instructing athletes to use specific spike jump approach and landing techniques may help to improve kinematic parameters or reduce load on lower extremities.

Sozbir (2016) determined the effects of 6-week plyometric training on vertical jump performance and electromyography (EMG) activities of vastuslateralis (VL), vastus medial is (VM), and gastrocnemius (GAS) muscles during countermovement jump (CMJ). Twenty-four highly physically active physical education students were randomly assigned either to a plyometric (PLY) group or a control group. The experimental group performed

plyometric exercises 2 times a week for 6 weeks, whereas the control group participated only in their lectures. The results revealed that there were no significant changes in either vertical jump height or EMG activities of selected muscles for the control group (p greater than 0.05). However, after 6 weeks of plyometric training, significant improvements (p less than 0.05) were observed in EMG activities of VL (13.25%), VM (9.60%), and GAS (13.93%) muscles, and no significant increase (p greater than 0.05) was found in CMJ (2.77%) in the PLY group. In conclusion, the findings of this study suggest that 6 weeks of PLY training, in addition to the regular academic program, induced significant improvements in EMG activities of lower extremity muscles but no significant increases in vertical jump height. Accordingly, PLY exercises are recommended as part of a regular academic program in order to increase important components of athletic performance for physical education students.

Almoslim Hassan (2016) found out the impact of six weeks of combined plyometric-resistance and combined plyometric-sprint trainings on the fitness elements among male students. 143 males aged 18 to 22 years were categorized into 3 groups, Plyometric-Sprint Training (PST, n = 48), Plyometric-Resistance Training (PRT, n = 47) and
a Control Group (CG, n =48). The experimental groups trained for 40 min per workout 2 days a week, for 6 weeks. Before and after training, tests were assessed on body composition, speed, power and agility. ANOVA and paired t-tests were used for analysis. The outcomes of all the components of this investigation showed that both the PST and the PRT revealed significantly greater reduction in the mean values than the CG ($P<0.05$), but no change was recorded between them in 30 m, 40 m and a 50 m run ($P<0.05$). However, in the Illinois agility test and standing long jump, the PST significantly exhibited greater declines in mean different values than the PRT<0.05). PRT and PST protocols have effectiveness for acceleration, speed, power and agility. PST showed reduction in agility and an increment in explosive power than PRT, but had same speed.

ShaikMannan and Johnson (2015) determined to improve the speed, power and agility of male volleyball players through volleyball specific plyometric training. To achieve the purpose, 30 male volleyball players were selected randomly from Telangana State Social Welfare Residential Junior College, Armoor, Nizamabad, Telangana. The

selected subjects were assigned into 2 groups: control group (n=15) and plyometric training group (n=15). The selected subjects were tested before and after twelve weeks of plyometric training on speed, power and agility. The results of the study showed significant improvement on speed, power and agility ($p < 0.05$). It is concluded that twelve weeks of volleyball specific plyometric training showed improvement of 2.49% in speed, 13.51% on power and 1.93% in agility. This training clearly shows that vertical jump performance shows greater improvement than speed and agility. This would significantly improve their spiking and blocking ability by jumping higher and ability to moves quickly in all direction while playing volleyball.

Chapter – III

Research Methodology:

Selection of the subjects/Sample

Forty (n=40) aged 17 to 25 years elite athletes from Rajasthan will be pooled for this controlled experiment, by employing fishers random table sampling technique. Making the use of table random numbers all the 40 subjects will be divided randomly into four matched groups viz., Group –A (Yoga group), Group –B (Plyometric group), Group –C (Plyometric plus yoga group), and group-D (Control group). Thus, each group will consist of 10 subjects.

Development of training schedules

Plyometric exercise and yoga training programmes will be designed by using standard process.

Group-A: Experimental group will undergo a Yoga training program and will participate in related sports training.

> **Yoga for flexibility:** Chakrasan, Paschimottasan, Matseyndrasan, Dhanurasan, Janu Sheershasan, halasan
>
> **Yoga for leg power and explosive strength:** Vrikshasan, Veerbhadrasan Utkatasan, kagasan, Natraj Asan.

Group-B: Experimental group will undergo a Plyometric training program and will participate in related sports training.

Group-C: Experimental group will undergo a training program on selected plyometric exercise plus yoga practices and related sports training.

Group-D: Control group has to participate in the related sports training

All the four groups will participate in the activities as per routine of university event.

Selection of variables

After going through the literature available and understanding various factors associated with the problem Following variables will be test during the study:

- ✓ Explosive strength;
- ✓ Stride length;
- ✓ Dynamic Balance;
- ✓ Selected coordinative abilities;
- ✓ Flexibility;
- ✓ High jump performance.

1. **Explosive strength:** Explosive strength, a component of speed strength, refers to acceleration or rate of force development, or "the neuromuscular system's ability to generate high action velocities." Explosive Strength: It is the ability to overcome resistance with high speed. It is used in take-off jumping events like long jump, high jump, triple jump, jumping in volleyball for smashing or spiking, jumping for rebound in basketball.

2. **Stride length:** Stride length is the distance between successive points of initial contact of the same foot. Right and left stride lengths are normally equal. Cadence or walking rate is calculated in steps per minute. Velocity, the product of cadence and step length, is expressed in units of distance per time.

3. **Dynamic balance:** Dynamic balance is the ability to maintain postural stability and orientation with center of mass over the base of support while the body parts are in motion. There are two types of balance, static and dynamic. Static balance is defined as balancing in one place without movement, whereas dynamic balance is defined as balancing with movement such as walking or reaching forward.

4. **Coordinative abilities:** Coordinative abilities are those abilities of an individual which enable the individual to do various related activities properly as well as efficiently. Our accuracy rhythm flow and constancy depend on our coordinative abilities. Coordination ability means an ability to quickly and purposefully perform difficult spatio-temporal movement structures. Within this context, coordination abilities are understood as an externally visible manifestation of the control and regulation processes of the motor activity of the central nervous system.

5. **Flexibility:** Flexibility is the ability of a joint or series of joints to move through an unrestricted, pain free range of motion. Although flexibility varies widely from person to person, minimum ranges are necessary for maintaining joint and total body health. Flexibility is defined as the range of motion of your joints or the ability of your joints to move freely. It also refers to the mobility of your muscles, which allows for more movement around the joints.

6. **High jump performance:** The high jump is a track and field event in which competitors must jump unaided over a horizontal bar placed at measured heights without dislodging it. The Fosbury Flop is a jumping style used in the track and field sport of high jump. It was popularized and perfected by American athlete Dick Fosbury, whose gold medal in the 1968 Summer Olympics in Mexico City brought it to the world's attention.

Performance of the Subject

The performance of each subject will be measured by using standard procedure of Athletic Federation of India. The athletes vertically jump and clear the bar and the performance will be measured from the height clear by the athlete.

Administration of test and collection of data

The experiment will be conducted in three phases:

- ✓ **Pre-Test**
- ✓ **Treatment / Training, and**
- ✓ **Post Test.**

Pre-Test

Following variables will be tested in the pre-test:

- Explosive strength;
- Stride length;
- Dynamic Balance;
- Selected coordinative abilities;
- Flexibility;
- High jump performance.

Treatment / Training

After pre-test is over, the subjects of experiment and control groups will undergo different training schedules as stated earlier.

The specific training will be imparted to respective group daily 1 hour in the evening, except Sundays and holidays. However, total duration of the experiment will be for a minimum period of 12 weeks.

Post Test

After completion of the training / treatment period of a minimum 12 weeks, the subjects of both the groups will be again tested like pre-test with the selected variables and data will be processed for statistical analysis.

Research Design

The present study will be experimental pre-post intervention-based research. Its experimental research designs.

Ethical Consideration

Prior to the experiment, informed consent of all the participants will be taken with standard format (as per the Declaration of Helsinki). Accordingly, permission from the individual(s) will also be taken before commencement of the experiment.

Statistical Techniques to be used

Primarily the data will be analyzed using descriptive statistics. Further, they will be processed through inferential statistics i.e., Two-way mixed ANCOVA followed by Scheffe's post hoc test.

Chaptalization for thesis:

Chapter – I: Introduction

Chapter – II: Review of Literature Chapter

– III: Methodology

Chapter – IV: Results and Observations

Chapter – V: Discussion

Chapter – VI: Summary and Conclusion

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